PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

see form PCT/ISA/220

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)* see form PCT/ISA/210 (second sheet)	
Applicant's or agent's file reference see form PCT/ISA/220	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2005/000493	06.01.2005	06.01.2004

International Patent Classification (IPC) or both national classification and IPC
INV. H01M6/16 H01M10/40

Applicant
MOLTECH CORPORATION

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:	Date of completion of this opinion	Authorized Officer
European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	see form PCT/ISA/210	Kuhn, T Telephone No. +31 70 340-8969

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2005/000493

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

      ☐ a sequence listing

      ☐ table(s) related to the sequence listing

   b. format of material:

      ☐ on paper

      ☐ in electronic form

   c. time of filing/furnishing:

      ☐ contained in the international application as filed.

      ☐ filed together with the international application in electronic form.

      ☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2005/000493

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	4,5,9-12,23,24,30,31
	No:	Claims	1,2,3,6-8,13-22,25-29,32-36
Inventive step (IS)	Yes:	Claims	4,5,30
	No:	Claims	1-3,6-29,31-36
Industrial applicability (IA)	Yes:	Claims	1-36
	No:	Claims	

2. Citations and explanations

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item VIII.

The application does not meet the requirements of Article 6 PCT, because claims 1, 21, 25 to 27,35 and 36 are not clear.

The term "N-O-additives" used in independent claims 1, 21, 27 and 36. is vague and unclear and leaves the reader in doubt as to the compounds and their structure to which they refer, thereby rendering the definition of the subject-matter of said claims unclear, Article 6 PCT.

Although claims 1 and 27 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and as such do not meet the requirements of Article 6 PCT.

Claims 25, 26 and 35 do not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The claims attempt to define the subject-matter in terms of the result to be achieved (the N-O additives was included ... and ... introduced") without providing the technical features necessary for achieving this result.
Furthermore the features of the product claims 25, 26 and 35 relate to a method of manufacturing the electrochemical cell rather than clearly defining the product, namely the electrochemical cell, in terms of its technical features. The intended limitations are therefore not clear from this claim, contrary to the requirements of Article 6 PCT.

Re Item V.

1. Reference is made to the following documents:
   D1 : WO 99/19931 A (POLYPLUS BATTERY COMPANY, INC; CHU, MAY-YING; DE JONGHE, LUTGARD, C; V) 22 April 1999 (1999-04-22)
   D2 : US 5 882 812 A (VISCO ET AL) 16 March 1999 (1999-03-16)

2 INDEPENDENT CLAIM 1

2.1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 is not new in the sense of Article 33(2) PCT.
Document D1 discloses (the references in parentheses applying to this document):

An electrochemical cell comprising: (a) a cathode comprising an electro active sulfur-containing material; (b) an anode comprising lithium; and c) a nonaqueous electrolyte

(lines 17,18, page 1: lithium-sulfur batteries), wherein the electrolyte comprises: (I) acyclic ethers resp. cyclic ethers (glymes resp. crown ethers page 5 lines 20 to 39 and page 19 line 30 to page 20, line 2); (ii) one or more lithium salts (page 20, lines 13 to 21); and (iii) nitromethane as additive (page 19, line 28).

2.2 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 is not new in the sense of Article 33(2) PCT.
Document D2 discloses (the references in parentheses applying to this document):

An electrochemical cell comprising: (a) a cathode comprising an electro active sulfur-containing material; (b) an anode comprising lithium; and © a nonaqueous electrolyte (col. 2, lines 36 to 42: lithium-sulfur batteries), wherein the electrolyte comprises: (I) for example acyclic ethers or cyclic ethers(e.g glymes, polyglymes resp. THF column 4, line 3 to 17); (ii) one or more lithium salts (for example $LiCO_3$) and (iii) lithiumnitrate or organo nitrogen compounds as additive (col. 3, lines 49 to 57).

3 INDEPENDENT CLAIM 21

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 21 is not new in the sense of Article 33(2) PCT.
Document D1 discloses (the references in parentheses applying to this document):
A battery comprising a casing (page 9, line 2) and a cell of claim 1 (see the cited passages under point 2.1 of written opinion). To put more than one battery in a casing resp. to stack cells is general knowledge for a long time.

4 INDEPENDENT CLAIM 27

As independent claim 27 has all the features of claim 1 (except for the feature that the electrolyte comprises also one or more lithium salts, which is only present in claim 1) also claim 27 lacks novelty with respect to document D1 or document D2 (see the cited passages of D1 resp. D2 under point 2.1 resp. 2.2 of this written opinion).

5 INDEPENDENT CLAIM 36

As independent claim 36 has all the features of independent claim 21 (except for the feature that the electrolyte comprises also one or more lithium salts, which is only present in claim 21) claim 36 also lacks novelty with respect to document D1 (see the cited passages of D1 under

point 3 of this written opinion).

6 DEPENDENT CLAIMS 2, 3, 6-20, 22-26, 28, 29, 31-35

Dependent claims 2, 3, 6-20, 22-26, 28, 29, 31-35 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2) and (3) PCT).

6 Novelty

6.1.1 D1 also discloses the additional features of dependent

- claims 2, 6, 28 (nitromethane additive (page 6, line 6) or other organic nitrates (page 18, lines 23 to 26))
- claims 7, 8, 24 and 32 (page 20, lines 13 to 20: $LiN(CF_3SO_2)_2$ or $LiCF_3SO_3$)
- claim 13 resp. 14 (page 3, line 29 to 34: dimethoxyethane (glymes) resp. THF)
- claim 15 (page 5, lines 25 to 28)
- claim 17 (page 9, lines 12 to 16: 10 to 90% sulfur by weight in the electrodes).
- claim 18 (page 21, lines 10 to 14)
- claim 19 (page 1, lines 16 to 17)
- claim 20, 33 (page 9, lines 29 to 30)

6.1.2 D2 also discloses the additional features of dependent

- claim 2, 3, 22, 29 (lithium nitrate additive, see D2, col 2, lines 49 to 57)
- claim 15 resp. 16 (col. 4 lines 3 to 17: diglymes resp. sulfolanes)
- claims 25, 26, 34 and 35 (claim 8: the lithium nitrate or organo nitrogen is a surface active agent (thus can be applied to either the electrode surfaces or the separator surface)

6.2. Inventive Step dependent claims 9-12, 23, 24 and 31

6.2.1 The feature to add nitromethane or ANother organic nitro compound to the liquid electrolyte of the lithium sulfur cell (see page 18, lines 3 to 8) is described in document D1 as providing the same advantages as in the present application (see D1 page 4, lines 22 to 24). The skilled person would therefore regard it as a normal design option vary the amount of organo nitro additive (e.g. nitromethan) described in document D1 in order to solve the problem posed, namely to optimized liquid electrolyte lithium-sulfur battery. Therefore claims 9 to 11 and 31 do

not involve an inventive step.

6.2.2 The reasoning under point 6.2.1 of this written opinion applies for dependent claim 12 accordingly. Furthermore, the use of different concentrations of lithium salts in liithium-sulfur-batteries are general knowledge for a long time.

6.2.3 As lithium sulfur batteries with dioxolane based electrolytes are known for a long time and from D1 (see page 4, line 8) it is a design option to include this efficient solvent in the solvent mixture of the lithium sulfur battery electrolyte (which comprises nitromethan or organic nitro compounds and dimethoxyethane) as disclosed in D1. Therefore also claims 23 and 24 do not involve an inventive step.

7 DEPENDENT CLAIMS 4, 5, 30

The combination of the features of dependent claims 4, 5 resp. 30 are neither known from, nor rendered obvious by, the available prior art. Neither does any of the cited documents suggest to use one of the nitrites of claim 4 or 5 resp. 30 as additives in lithium sulfur cells of claim 2 resp. 29 nor is it common knowledge to do so.